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Q&A With Luther Williams

NSF Education Programs On Fast Track to Big Bucks

A biologist and former President of Atlanta University, Luther S. Williams has served since June 1990 as head of the National Science Foundation's Directorate for Education and Human Resources, the fastest growing and least publicized part of the Foundation. Williams spoke to SGR Editor Greenberg on March 6. Following is the text, transcribed and edited by SGR.

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Q. There seems to be little awareness in the scientific community of the scale of NSF's education programs, particularly in the pre-college area.

Williams. I agree, and it confounds me. This year, the Foundation is reaching directly some 25,000 K-12 [kindergarten through 12th grade] math and science teachers, and the program also involves the participation of over 6000 university-level math, science, and engineering professors, in community colleges, regular four-year institutions, and research institutions. K-12 is the largest component, $275 million out of the $465 million budgeted for this Directorate. Within the pre-college sector, our highest priority is the quality of the instructional workforce, focused on the two million teachers who are already in the workforce.

Q. How do you reach them?

Williams. The main method is through summer institutes, typically run by colleges and universities under grants and contracts from NSF. They provide intensive, minimum-of-four-week experiences. What the teachers are doing is going to college. It's roughly equal to a summer-school session. After that session, we give them a small amount of money during the following academic year to make sure they actually implement what has been learned.

Q. How much money?

Williams. It's about $1100, on the average, per teacher. It's to make sure that the courses they are giving in science and math are based on the curricula that they are expected to deliver in the schools. The money can be used for materials or a modest increase in computational equipment. In some cases, the summer program is designed to allow a master teacher to go back and impact his or her colleagues. The leveraging or multiplier effect—that is, one teacher impacting others—is at least five-fold. So, after this coming summer, the impact is really on well over 100,000 teachers.

Second, in terms of priority, is the curriculum. Assuming improvement in the preparation of the teachers, the question

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Freedom of Information?

NASA Memo Tells How To Hide Documents from Public

And now another spinoff from NASA: a tutorial in how to elude the Freedom of Information Act (FOIA), a bonus find by Congressional investigators rummaging through space agency records in quest of other matters.

Among the wily suggestions in the document: destroy old notes; avoid cross-references that might lead to other documents; write in print rather than script to conceal authorship; and, if trouble arises, get the lawyers involved in document preparation so that disclosure can be denied under the FOIA exemption for "attorney work product privilege."

The anti-FOIA instruction, titled "Suggestions for An-

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In Brief

Responding to White House Science Adviser D. Allan Bromley's request for recommendations to save science in the ex-Soviet Union, the National Academy of Sciences has urged quick assistance to keep researchers there at work and out of mischief in behalf of third-world nuclear aspirants. Among the items: $50 million to $100 million for journals and equipment, funding of research from $400 million designated for weapons dismantlement, and $25 million for a previously announced International Science and Technology Center in Moscow. The proposals were developed March 3 at a meeting of 120 academic, government, industrial, and foundation representatives at the Academy.

NIH is still on the trail of unknown millions of dollars' worth of missing office and lab equipment, three months after Director Bernadine Healy described the results of a "wall-to-wall inventory" as "highly disturbing" [SGR, January 15]. A second look around the Bethesda campus substantially reduced the initial count of $33 million (current value) in missing gear. The inventory is still being tallied at headquarters, where the word is that a lot of stuff remains unaccounted for.

With Democrats hammering Bush for neglect of industry, Science Adviser Bromley has rushed in with a response—a modest one. On March 6, Bromley summoned the press to announce that the Federal Coordinating Council for Science, Engineering, and Technology had decided to develop a government-wide R&D program in advanced manufacturing. If approved by the President, it will be anointed as a Presidential Initiative.

. . . Further Advice on How to Conceal Official Papers

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ticipating Requests Under Freedom of Information Act," was released at a hearing last month by the Subcommittee on Investigations and Oversight of the House Science, Space, and Technology Committee. Apparently prepared in November 1989, the document was discovered in the course of the Subcommittee's investigation of the SP-100 nuclear space-reactor program.

According to a memorandum on Department of Energy stationery, an inter-agency group met on October 30, 1989, at the NASA Lewis Research Center, Cleveland, to plan a review of the SP-100 project. Various assignments were handed out, including one to Lawrence J. Ross, then Deputy Director of the Lewis Center, to "prepare and distribute a one-page summary sheet on FOIA guidelines." The minutes of a meeting on November 21 state that the assignment had been carried out by Ross, who became Director of the Center in 1990.

Covering two typewritten pages, the NASA tip sheet states at the outset that the FOIA "requires that copies of all documents maintained in the course of conducting Government business must be provided to requesters unless the documents fall within certain narrow exceptions. As a result," it points out, "the safest and most practical course of action is to prepare all documents in a manner that assumes they will ultimately be disclosed." NASA then proceeds to the fine points of how to evade federal law:

"Avoid retaining drafts of documents. Each draft constitutes a separate document potentially subject to disclosure.

"Use yellow stick-ons or other similar attachable tabs to annotate personal copies of documents you wish to retain. Annotations on a document make the annotated copy a separate document potentially subject to disclosure. If retained, yellow stick-ons would also be subject to FOIA disclosure. However, since there is no obligation under FOIA to provide documents in any particular order or relationship to each other, furnishing out of context copies of stick-ons can render any information released less meaningful. In this context, printing rather than writing in script also generally makes it harder to assign authorship (and context) to a particular note or document."

Noting that to protect frank discussion within the government, FOIA exempts disclosure of "memoranda and correspondence that are pre-decisional and deliberative in nature," the instructions include the following:

"Clearly identify and draft documents as recommendations rather than decisions.

"If you must document a decision, make sure that it is consistent with the decision that you ultimately intend to make public. Do not cross-reference any pre-decisional documents or prior recommendations in a decisional document unless you intend to specifically adopt them as part of your decision."

As NASA realizes, however, things can go wrong, even in matters so simple as violating the Freedom of Information Act. The instructions tell what to do in that case:

"At the first indication of any potential controversy with outside parties, involve your legal counsel. Not only can he or she provide specific advice on FOIA, but counsel's participation in the preparation of particular documents may serve as an additional basis for asserting that they are exempt from FOIA based on a claim of attorney work product privilege."

In a letter dated February 24 to NASA chief Richard Truly, Subcommittee Chairman Howard Wolpe (D-Michigan) stated that these instructions violate the spirit and intent of the FOIA and added that "deliberate destruction of government records" is a federal crime. Truly, fired last month by the President and due to leave office April 1, expressed shock and said he would look into the matter.

The reality of the FOIA is that it lacks teeth, and federal agencies routinely violate it—with or without instructional memos on how to cover their tracks. Requesters who persevere often do get what they're seeking, but when an agency is determined to conceal documents, it usually finds a way, unless an insider leaks copies or a Congressional Committee can be enlisted to blast them loose.

Shift Proposed for OSI

A proposal for an extensive reorganization of the Office of Scientific Integrity (OSI) is awaiting a decision by Health and Human Services Secretary Louis Sullivan, but given the gridlock in paper movement in the Department, forecasts on timing vary widely.

The proposal calls for administratively relocating the much-troubled office as an arm of the Public Health Service, directly under the Assistant Secretary for Health. The present OSI theoretically covers all the scientific components of the PHS, but it reports to the Director of the National Institutes of Health and has confined its activities to misdeeds by grantees of NIH and the closely associated Alcohol, Drug Abuse, and Mental Health Administration. NIH would happily shed responsibility for the so-called cop shop.

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. . . Curriculum Development Tied to Summer Institutes

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is the currency, the appropriateness of the curriculum. Because of tracking in the school systems, there's an amazing diversity in terms of curriculum. We have taken the whole K-12 and organized it into three broad areas of curriculum. There's a major project that deals with K-6 science and mathematics. For the majority of those teachers, that really means science and math for the first time. Second, there's a large curriculum project that builds on the elementary curriculum for middle-school science and mathematics. And then, finally, high-school science and mathematics.

Q. NSF's summer institutes were abolished some years ago on the grounds that there was no evidence of effectiveness. Some say that was a bum rap.

Williams. So do I. I can't argue the level of success, but there's little doubt in my mind that they made a very important contribution. We would have a remarkably different kind of problem today—or a remarkably reduced capacity to respond to the crisis—if it were not for those institutes.

Q. How do you get the new programs into the schools?

Williams. Initially, the grants go to science and math educators in colleges and universities who develop the curriculum. But built into each project is a requirement for dissemination and implementation. There's a connection between the curriculum development that we sponsor and the summer institutes for the teachers. They're both NSF-sponsored, and we link the two.

After teachers and the curriculum, the third large activity within the pre-college sector is informal science education. This includes explicit math and science instruction for youngsters primarily through Children's Television Workshop, a program that I consider one of the most important things we do. Another very important thing that we have promoted recently is to encourage our Children's Television Workshop to actually involve teachers. The idea is that a youngster can see the connection between what's happening on television and what's taking place in the regular class.

They're on the air each week for two-and-a-half hours. In a survey done about a year ago at our initiative, 30 percent of the American school students enrolled in science and mathematics watched these shows. The challenge is to connect that experience with what is taking place in the regular schools so that it really is synergistic and complementary.

We also have within the pre-college sector a program called Young Scholars. The idea is literally to extract talented students from the school system, and give them during the summer an intensive program—starting roughly in grade 7. This provides them with an opportunity for enormous enrichment in science and math.

Q. Where does that take place?

Williams. Typically in colleges and universities, and especially recently, in community colleges. It's done in a non-residential mode, so the youngsters can live at home and come to their local schools.

Education at NSF

Booming After Oblivion

Pre-college science and math programs at the National Science Foundation have made a phenomenal comeback from a total wipeout by the Reagan Administration, which dismissed them as just another government boondoggle. Congress forced a revival of the programs in 1983, and has since poured on the money.

This year, in a total NSF budget of $2.5 billion, the NSF Education and Human Resources Directorate is budgeted for $465 million, of which $275 million is for programs devoted to science and math in kindergarten through 12th grade. In 1984, the first year of the revival, the NSF education budget stood at $54 million, of which $31 million was in the pre-college category.

That was the year in which Bassam Z. Shakhashiri, from the University of Wisconsin, came on board as head of education at NSF. With Congress and the public bemoaning the state of science and math education, Shakhashiri successfully lobbied for rapid expansion of the education budget. Congress then went into cycles of regularly exceeding the White House request for science education—by trimming funds from NSF's research accounts. In 1988, for example, $115 million was requested for education, and Congress appropriated $139 million.

Shakhashiri insisted that education was merely catching up from the Reagan drought. But along with the money, he harvested the resentment of NSF's research directorates.

In 1990, just before NSF Director Erich Bloch left office upon completion of the statutory six-year term, he summarily removed Shakhashiri from the education post, merely telling him, Shakhashiri later said, that he had held the job too long. In his place, he appointed Luther S. Williams, who had been serving as Bloch's Senior Science Adviser.

The ouster of the politically popular Shakhashiri was strongly protested by his Congressional admirers. But the deed was done and soon forgotten. Shakhashiri later returned to the University of Wisconsin.

Education and Human Resources still remains a Congressional favorite.

Q. How many children are involved?

Williams. We have exceeded 8000 this past summer. And we will be very close to 11,000 youngsters this summer.

Q. What is the budget for this program?

Williams. About $14 million.

Q. Who receives the money?

Williams. Two-thirds of the money is to the PI [principal investigator] and the faculty that actually delivers the pro-

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. . . Grants for Multidisciplinary Centers for Teachers

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gram. At the end of the summer, the students get a modest stipend, about $900, to make sure that working at McDonald's is not in conflict with staying in the program.

The other activity within the pre-college sector has to do with supporting research that looks at issues like cognition. What we're trying to do is keep our knowledge ahead of curriculum development and continue to explore different strategies for instruction in science and mathematics, and also deal with the issues of how students learn. A lot of our programs are interventional. So, we really need to know, if a youngster has not had very good math instruction up to grade 6, can you effectively compensate for previous years?

Q. What are you doing in educational technology?

Williams. We do a lot of research in a program called Advanced Applications for Technology. There's an excellent computer-based math instruction unit called Logo. We sponsored all of the undergirding research. What it allows, in a very creative fashion, is the use of software as a medium for instruction in mathematics—not the blackboard. Very effective. There's a deliberate linkage between the curriculum-development people and the people doing the technology development.

The most recent entry in terms of technology is networking. Both our House and Senate committees have urged this Directorate to work collaboratively with [NSF's] CISE [Computer and Information Science and Engineering] Directorate, where, in fact, there is a network for research. And what we're going to do through the National Research and Educational Network is support computer networks of schools, so that a teacher in rural Nebraska will have access to all of the information that is available.

Another idea we have, still in the embryonic stages, is to see whether we could use the computer-based communication networks for disseminating curriculum material. The goal is to level the playing field in terms of resources, so that a teacher can draw on the national pool.

Q. What about the next generation of teachers?

Williams. We're attempting to challenge colleges and universities to reorganize their resources for preparing teachers. You have to ask how would you organize a college or university to produce an ideally prepared 8th grade math teacher? You don't want that person to go to college and take a degree in the school of education, removed from the math department. On the other hand, you don't want the person to take an undergraduate degree in mathematics with no appreciation of pedagogy and methodology. So, we have now moved to essentially a centers mode for teacher preparation. We're asking the colleges and universities to organize themselves in an interdisciplinary fashion.

Q. How many centers have been established?

Williams. We have $14 million, sufficient to start 14 to 18 such centers next year, at close to $1 million each.

Q. What are you doing at the undergraduate level?

Williams. We have a faculty-enhancement program, especially for faculty in two-year institutions, where, divorced from a research ambience, there's a critical issue of the currency of, say, a chemistry professor who took a degree 15 years ago. These people have a very important role in introductory courses. Chemistry, physics, math teachers are brought during the summer to workshops, where their skills and knowledge bases are enhanced broadly in all areas. For example, the impact of computer sciences, a comparatively new field, on instruction in chemistry and physics are the kinds of things we work on with the teachers.

In undergraduate engineering, there has not been a major curriculum revision probably in 25 years. There has been tinkering, but not a major revision where one basically asks the following questions: In 1992, how could one use technology in delivering the engineering curriculum? How should one couple pre-engineering and engineering? The first couple of years in an undergraduate program in engineering are not in the school of engineering. They're in math and science departments. Should students have no introduction to engineering until they actually get into the engineering program? Typically, in college and university, there's a modest course called engineering design. What we are supporting now are some innovative curriculum projects where in those first two years, when the students are studying science and mathematics in general, they're in the context of engineering-design problems. So, they are actually studying engineering, using their basic science knowledge to do engineering.

In biology, the incredible challenge there, conceptually, is what should constitute a general course. Take three periods in biology: prior to the 1950s and the discovery of the structure of DNA; 1950 to 1980, the advent of molecular cloning, and the last 15 or so years, during which more has been discovered in biology than in the previous 200. So, what is a course?

Q. Who's working on these curriculum projects?

Williams. Professional societies. For example, in chemistry, the American Chemical Society. We support the professional societies in chemistry, physics, biology. But also working on them are inter-disciplinary teams of faculty in universities. My sense is that in science, engineering, and mathematics, the undergraduate arena has been underserved. Only between 6 and 7 percent of undergraduates elect to take majors in undergraduate science and engineering.

Q. Underserved even in the research universities?

Williams. Absolutely. How one addresses curriculum reform at the undergraduate level is almost institution-specific. There's a different set of problems in research institutions than there are in four-year colleges and they're different in community colleges.

The last program in the undergraduate arena is a program that we call instrumentation and laboratory improvement. The goal is to selectively fund colleges and universities to

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. . . Summer Camp Program for Minority Students

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produce state-of-the-art laboratory courses. One of the best examples is the use of computers in math courses. Before a grant is awarded, you have a classroom in which one professor performs with a blackboard. We make the grant, and you go back, and the classroom has been converted to a laboratory, and there are PCs on each bench. It's a computer-based instruction mode. That's even true in chemistry, where there are a lot of the routine, ancient experiments that every undergraduate has to do—historic experiments, they're important intellectual experiences. But they can be done much more efficaciously if you automate the process.

Q. How much are you spending on the laboratory-enhancement program?

Williams. It's about $30 million. This last fiscal year we made 690 grants. They're matching grants that require an equivalent sum from the institution.

Q. How are you responding to concerns about the small number of minority members in science and engineering?

Williams. The budget for that effort has gone from $25 million to $60 million in two years. In the case of minorities, we have programs that literally start at grade 6 and end with the undergraduate degree. The flagship, the program that I think is going to make the most difference, is what's called the Alliance for Minority Participation. We have better than 6000 minority students in the program. And the participating institutions have the goal of doubling that number. So, if it works, as we expect, I think for the first time ever we're going to have an exemplary outcome. I'm not criticizing the previous programs, but they were typically operated without explicitly looking at outcomes. The institutions had the grants and they were asked to, quote, improve minority participation in undergraduate programs, unquote. Well, in my judgment, the only measure is an increase in the number of youngsters getting degrees.

Q. At what grade does the minority program start?

Williams. At the 6th grade. Throughout the nation, a large pool of minority students, some 7000, are going to be involved in summer camps, this coming summer. This process is to the exclusion of all other things. With these youngsters, not only is it important that they learn science and mathematics, it's important that you also deal with a whole series of affective elements, and literally keep them from the community for the summer.

Q. Who runs the camps?

Williams. Colleges, universities, and community-based organizations, the Urban League, the Hispanic Society in San Diego. In the 7th, 8th, and 9th grade, they can repeat this program. Then they graduate to a program that's less intensive. We should eventually have 65,000 youngsters participating through high school.

Q. When these children reach college age, will they receive financial assistance under this program?

Williams. Some will and some will not. The fundamental goal is to present to the nation a cadre of minority high-school graduates who have taken the appropriate courses in science and mathematics. If we can do that, 75 percent of the problem has been addressed. If they are excellently prepared, there is plenty of financial support.

Q. How will you know if programs are working?

Williams. We build into every single grant an evaluation component that starts the day the grant is made. Take Summer Institute X: We make a grant for an intensive program in the summer of '92. They run the program, and then the following academic year they follow the teachers. At the end of the academic year '92-'93, they have to give the Foundation an evaluation. In addition, I have established a national evaluation unit independent of the PI's [principal investigators]—a third party—for all of the teacher-enhancement programs or the institutes.

Q. Your budget has been one of the fastest growing in the US government.

Williams. We have done well.

Q. The friends of science education in Congress have looked after you. Is anything here constrained by money?

Williams. With the increased resources, we usually get new programs suggested by the Congress. That has been a serious challenge, in terms of organizing those programs.

Q. The budget here is about $500 million. How many people do you have to handle that money?

Williams. About 150, professional and support staff. I had 115 when the budget was 40 percent of what it is now.

Q. You're relying on universities to improve science at the pre-college level. It's not their normal business.

Williams. It's not their normal business, but they're quite responsive. One of the important advantages for the K-12 sector is that colleges and universities are in a rather fluid state. Math and science departments, even education departments, that used to be comparatively indifferent to the needs of the K-12 sector, are finding it advantageous to make a career as math educators, as opposed to mathematicians.

Q. Among your many programs, is there any one you consider the most important?

Williams. When you put it all together, the Statewide Systemic Initiative is the most important effort that the Foundation or any other agency has undertaken in education. We're working on many programs. And each state has a collection of school districts and within those are individual schools. What you desire is that they work to reform the whole system. The Statewide Systemic Initiative isn't a grant in the typical NSF vernacular. It's a cooperative agreement, which says that in year one of the grant, we and the state have agreed that these are the, let's say, 16 deliverables. We're raising the bar in terms of accountability and expectations. We're also insisting on indicators for all the programs right from the start.

Q. You don't start a program and cut it adrift?

Williams. No. That is what we can't afford to do.

Fingerprints All Over the DNA Fingerprinting Episode

Threatened with a libel suit by *Science* Editor Daniel E. Koshland Jr., the British *New Scientist* has published an apology for reporting that *Science* yielded to FBI pressure in its treatment of a paper critical of DNA fingerprinting.

Science published the DNA paper on December 20. But in what Koshland has acknowledged as a departure from the journal's standard editorial procedures, it simultaneously published a specially commissioned rebuttal of the paper. SGR has been informed that the rebuttal was twice bucked back by peer reviewers and finally made the grade after extensive revisions. SGR's call to Koshland for comment was unreturned.

The DNA identification technique, favored by the FBI and other law-enforcement agencies, has been criticized by a small but influential group of researchers as less reliable than its supporters claim. The issue has aroused considerable strife, with some of critics charging attempts at intimidation by law-enforcement officials. Bitter feelings prevail on this matter, particularly in regard to scientific supporters of the technique who hold research grants from the Department of Justice, parent agency of the FBI [SGR, February 15].

The *Science* article critical of the DNA technique was written by Richard Lewontin of Harvard and Daniel Hartl of Washington University. After it was peer-reviewed, accepted, and in galley, Koshland, claiming that criticisms had come to his attention, requested various changes. In addition, Koshland commissioned a rebuttal paper from two supporters of DNA fingerprinting, Ranajit Chakraborty of the University of Texas and Kenneth Kidd of Yale University. Along with the article and rebuttal, *Science* also published in the same issue a news story about the conflicting papers and the various charges and countercharges concerning them.

New Scientist reported the controversy on January 4, in an article headlined " 'FBI pressure' on journal forces climb-down." Referring to Koshland's "unprecedented step of publishing a rebuttal of the article in the same issue," *New Scientist* stated: "He appears to have done so in response to pressure from various parties with an interest in the technique." To which it added: "According to *Science*, the FBI tried to get the manuscript withdrawn, although John Hicks, head of the agency's crime laboratory, denies this."

Stating that the allegations of FBI influence were "untrue and libelous," Koshland, in a letter to *New Scientist* dated January 31, contended that the "article damages *Science*'s reputation and may have serious financial consequences for us." He added, "A retraction of equivalent prominence setting out the correct facts may perhaps avoid a costly legal action."

New Scientist obliged in the issue of March 7, stating that "We have been informed by *Science* that it did not receive any pressure from the FBI, and we have no independent evidence that it did.... We have also determined that nothing in *Science*'s own coverage of the matter indicated that it was subject to such pressure.... We apologize for the adverse inference to *Science*'s editorial integrity that such wording implied."

Koshland's performance in this matter still invites, at best, curiosity, particularly for an editor's note that he appended to a group of letters on the controversy in *Science* of February 28. Again denying that government intervention had been attempted or would be tolerated, Koshland then provided an account of the simultaneous publication of the pro and con articles on DNA fingerprinting. Repeating previously published reports that his concerns about the already accepted Lewontin-Hartl paper were aroused by criticisms expressed to a *Science* editor attending the October 1991 International Congress of Human Genetics, Koshland wrote:

"These scientists [who had seen a copy in press] were concerned that some of Lewontin and Hartl's more theoretical arguments were not adequately supported by data. *We had already been advised by peer reviewers that such concerns were correct, but that the article discussed issues of importance to those concerned with the application of DNA fingerprinting and should be published* [SGR's italics]. To represent this situation to our readers, we asked Lewontin and Hartl either to revise their article so that it was more consonant with the data or to have the article published as ... an opinion piece. When Lewontin and Hartl rejected these options, we asked Chakraborty and Kidd to write a ... Perspective from an alternative viewpoint. The decision to publish [the two articles] was guided by our desire to present to our readers the best and most up-to-date developments in contemporary science."

Koshland did not explain why the process of instantaneous rebuttal was uniquely applied to this particular paper. Nor did he illuminate the strange role of peer review in this instance. Referring to the criticisms raised at the Genetics Congress, Koshland wrote that the paper was initially accepted for publication, although "We had already been advised by peer reviewers that such concerns were correct...." But, it appears, after the concerns were reiterated at the Congress, Lewontin and Hartl were asked to revise the paper, and, finally, the rebuttal paper was commissioned.

According to various published accounts of Koshland's editorial turnabout, including one in the *New York Times* December 20, one of the critics of the Lewontin-Hartl paper was C. Thomas Caskey of Baylor College of Medicine, who holds a $200,000 Justice Department grant for DNA fingerprinting research. Caskey, a member of *Science*'s Board of Reviewing Editors, licenses a DNA fingerprinting technique to a commercial company, the *Times* reported.—DSG

Correction: Science Attaches

In SGR's March 1 list of science counselors and attaches in Washington, the entry for France should have read as follows: Dr. Francois Armanet (materials science and processing); Dr. Michele Durand; Dr. Bruno Oudet (information technologies and networks).

More IN PRINT: Terrorism, Neurotoxicology, Dolphins

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Technology Against Terrorism: Structuring Security (GPO Stock No. 052-003-01272-3; 142 pp., $7.50) from the Congressional Office of Technology Assessment (OTA), the unclassified portion of the second and final report on studies requested by several Congressional committees, says federal agencies have improved their coordination on research, particularly in aviation security and in coping with chemical and biological terrorism, but more coordination and research are needed. "With current or near-term technology," OTA adds, "a system combining profiling and bomb-detection technology could be developed that could be expected to increase airline security." Also available, the first report in the OTA series: ***Technology Against Terrorism: The Federal Effort*** (GPO Stock No. 052-003-01246-4; 118 pp., $5).

Order from (checks payable to): Superintendent of Documents, USGPO, Washington, DC 20402-9325; tel. 202/783-3238. Add 25 percent for international orders.

Environmental Neurotoxicology (154 pp., $24.95, plus $3 shipping), from the National Academy of Sciences Committee on Neurotoxicology and Models for Assessing Risk, notes "convincing evidence that chemicals in the environment can alter the function of the nervous system." But of some 70,000 chemicals used in commerce, the Committee states, only a tiny portion has been tested for neurotoxicity. Since resources are lacking to test them all, the report says, new strategies are required, including studies to define mechanisms of toxicity, improved training of health workers and more attention to reporting toxic effects. The report was commissioned by the Agency for Toxic Substances and Disease Registry, of the US Public Health Service, and was produced under the chairmanship of Philip J. Landrigan, Mt. Sinai School of Medicine, New York.

Also from the Academy (scheduled for publication in June): ***Reducing Dolphin Mortality from Tuna Fishing*** (178 pp., price not yet available), a study mandated by the Marine Mammal Protection Act amendments of 1988 in response to emotions generated by deaths of dolphins caught in tuna nets. Covering the Eastern Tropical Pacific—prolific fishing grounds that stretch from Mexico to Peru—the study found no reliable technological means to reduce dolphin deaths, estimated at 52,000-56,000 in 1990. With the US fishing fleet in steep decline in recent years, only about 10 percent of the toll was attributed to American boats. Noting that fewer dolphin deaths occur when nets are set correctly and brought in quickly, the report recommends training for boat captains, closer monitoring of catches, and incentives for sparing dolphins. It also calls for research on net designs and studies of tuna and dolphin habits. The report was produced by the Academy's Committee on Reducing Porpoise Mortality from Tuna Fishing, chaired by Robert C. Francis, University of Washington, Seattle.

From the National Academy of Engineering: ***Time Horizons and Technology Investments*** ($19, plus $3 shipping), says long-term investments and planning by American industry are not as rare as economic doomsayers contend, but that many firms could benefit from a more patient approach to developing profitable products. Among steps recommended: more scientists and engineers on corporate boards, management bonuses based on multi-year performance, and, in government R&D programs, more attention to the "creation of long-lived physical and human capital or a knowledge base." Donald Frey, former head of Bell & Howell, chaired the panel that produced the report.

Order from (checks payable to): National Academy Press, 2101 Constitution Ave. NW, Washington, DC 20418; tel. 1-800/624-6242; in Washington, DC, area: 202/334-3313.

Defense Industry Initiative on Business Ethics and Conduct (92 pp., no charge), fifth in an annual series, born of the defense-contracting scandals of the '80s, describes steps by defense firms to promote ethical behavior and to prevent misconduct by employes. Included are discussions of hotlines and ombudsmen for reporting misdeeds, plus titles of publications and videos used in corporate ethics programs. The report lists 52 firms in the Defense Industry Initiative, and says they account for over half of the Defense Department's prime-contract expenditures.

Order from: Defense Industry Initiative, 1730 Pennsylvania Ave. NW, Suite 800, Washington, DC 20006; attn. Alan Yuspeh; tel. 202/383-7429.

Scientific Information Services of the National Cancer Institute (no charge), a packet describing publications, etc., available from NCI; order forms included.

Order from: NCI, International Cancer Information Center, Building 82, Room 100, Bethesda, Md. 20892; tel. 301/496-4907.

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IN PRINT: R&D Budget, Science and Growth, SDI

The publications listed are obtainable as indicated—not from SGR.

Views and Estimates of the Committee on Science, Space, and Technology on the Fiscal Year 1993 Budget for Civilian R&D (Serial H, 36 pp., no charge), from the House law-writing committee for NSF, NASA, NIST, and DOE and EPA research, and several other agencies, a recommendation for boosting civilian R&D by shifting $14 billion from defense over the next five years. By doing so, says the report, the Super Collider and the Space Station, both in the Committee's jurisdiction, can be financed without strain, as can programs for promoting civilian technology and science and math education. The report, mandated by the Congressional Budget Act of 1974, is intended to assist the House Budget Committee in its task of recommending budget allocations. This edition takes a more strategic and long-range view of R&D, reflecting the style of Rep. George Brown Jr., now in his second year as Committee Chairman. Included are recommendations from the 20-member Republican minority on the Committee calling for a 10-percent reduction in the increases proposed by the White House for the coming fiscal year. To be kept in mind is that the House Science Committee can recommend this or that and influence the Congressional mood, but power over money is held by the Appropriations Committee.

Order from: Committee on Science, Space, and Technology, US House of Representatives, 2320 Rayburn HOB, Washington, DC 20515; attn. Robert Palmer; tel. 202/225-4275.

Linkages Between Federal Research and Development Funding and Economic Growth (92-211 SPR; 19 pp., no charge), from the Science Policy Research Division of the Congressional Research Service (CRS, part of Library of Congress), finds "little doubt" that government-supported R&D boosts economic growth, but says measurements of the relationship remain elusive. Better understanding is desirable, the report states, because of political pressure for competitive gains from federal R&D spending, most of which was initiated for non-economic reasons. While US policy in this area remains unsettled, it adds, Japan and other nations "recognize the link between the R&D process and economic growth, even if a strong causal connection between the two cannot be quantified." The report warns, however, that misdirected federal R&D can exact some costs from the economy through programs that are "premature or excessive." Citing the ups and downs of federal spending on energy research as an example of wasteful research spending, the report adds, "There is much controversy about research in the health sciences in this connection. Many argue that it is wasteful to declare a 'war' on a disease, such as cancer, before certain fundamental problems are solved." The authors are Glenn McLoughlin, Specialist in Science and Technology, and Richard Rowberg, Chief of the Science Policy Division. The report is part of a CRS series on "Economic Policymaking in Congress: Trends and Prospects."

Order from: Science Policy Research Division, Congressional Research Service, Library of Congress, Madison Building, Washington, DC 20540; attn. Ms. Raap; tel. 202/707-7014.

Measuring Internationalization of Science (250 pp., no charge), from a unit of the *Centre National de la Recherche Scientifique*, French counterpart of the US National Science Foundation, a collection of papers on trends in multi-national research collaboration, with co-authorship across borders as the principal indicator of internationalization. The data used are from Science Citation Index and cover eight major disciplines and 98 countries. Subjects include Japan's linkages with the US, Europe, and Asia; Canada and the EC; changing patterns in scientific ties among universities, and scientific collaboration in the Arab nations. Among the findings: "International collaboration makes up an increasing proportion of Japan's scientific production." Of all articles by Japanese scientists, those with international co-authorship rose from 3.5 percent of the total in 1976 to 7.4 percent in 1986.

Order from: Jean-Francois Miquel, Directeur, Laboratoire d'Evaluation et de Prospective Internationales, 28, rue Boyer, 75020 Paris, France; tel. 331/43 58 52 81.

Strategic Defense Initiative: 15-Year Funding Requirements (GAO/NSIAD-92-92FS; 29 pp., no charge), from the General Accounting Office (GAO), based on estimates provided by the Strategic Defense Initiative Organization, says plans for the missile-defense program call for spending $90 billion dollars (in 1991 constant dollars) between fiscal 1991 and 2005. The report was requested by House Armed Services Committee Chairman Les Aspin (D-Wisc.), who wants bigger defense cuts than the White House is planning.

Also from the GAO: ***Earth Observing System: NASA's EOSDIS Development Approach is Risky*** (GAO/IMTEC-92-24), warns of inadequacies in NASA's planning for handling the torrent of data expected from the Earth Observing System, a series of satellites that is estimated to cost $11 billion through the year 2000. "The intended scope of EOSDIS [Earth Observing System Data and Information System]," the GAO report states, "far exceeds that of any previous civilian data management system." But, it adds, "NASA's development strategy does not adequately identify and mitigate the significant technological risks inherent in a project of the size, scope, and technical complexity of EOSDIS." GAO says the development costs of the Data and Information System are estimated at $3 billion. The report was requested by Chairman George Brown Jr. of the House Science, Space, and Technology Committee.

Order from: USGAO, PO Box 6015, Gaithersburg, Md. 20877; tel. 202/275-6241.

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